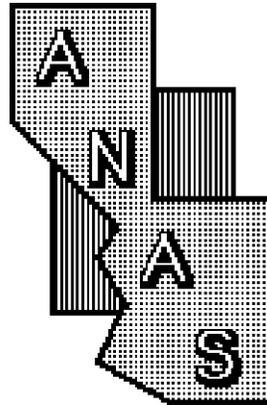


2009

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**PROCEEDINGS
ARIZONA-NEVADA
ACADEMY OF SCIENCE**



FIFTY THIRD ANNUAL MEETING

April 4, 2009

**University of Arizona
Tucson, Arizona
2008-2009 Annual Reports**

**University of Arizona
Tucson, Arizona**

TABLE OF CONTENTS

ABBREVIATED SCHEDULE AND ACTIVITY LOCATIONS.....	3
SUMMARY OF SECTION MEETINGS	4
LUNCHEON SPEAKER.....	5
BIOLOGY/ CHEMISTRY/ MATHEMATICS SESSION.....	6
GEOGRAPHY SESSION	11
GEOLOGY SESSION	16
PSYCHOLOGY SESSION	29
POSTER SESSION.....	32
ACADEMY BUSINESS AND ANNUAL REPORTS.....	37
COMMITTEE ROSTER	38
PRESIDENT’S REPORT	39
MINUTES.....	40
MEMBERSHIP REPORT	42
OUTSTANDING SERVICE AWARD	43
OUTSTANDING TEACHER AWARD	43
GRANTS-IN-AID RECIPIENTS	44
SCIENCE BOWL/SCIENCE OLYMPIAD LIAISON’S REPORT	45
TREASURER’S REPORT.....	47

ABBREVIATED SCHEDULE AND ACTIVITY LOCATIONS

Friday, April 3

The Board of Governors will meet from 6:00 - 8:00 PM

Saturday, April 4

All section meetings on Saturday will take place in the Harvill building on the campus of University of Arizona, Tucson, AZ

7:00-8:30 am	Registration: Courtyard
8:00 - 10:00	Paper Sessions: See section schedule
10:00 - 10:30	Coffee Break and Poster Session: Courtyard
10:30 - 11:30	Paper Sessions: See section schedules
11:30 - 1:30	Annual ANAS Awards Luncheon and Annual Business Meeting: Coyote room, Park Student Union
1:45 - 2:45	Paper Sessions: See section schedules
2:45 - 3:15	Coffee Break: Courtyard
3:15 - 4:00	Paper Sessions: See section schedules

SUMMARY OF SECTION MEETINGS

Section	Session	Time	Room
Biology/Chemistry/ Mathematics	I	8:00	313
Geography	I	8:30	115
Geology	I	8:30	240
Hydrology	I	8:00	102
	II	1:45	
Psychology	I	8:20	316
Poster Session		10:00	Courtyard

All rooms are in the Harvill Building

LUNCHEON SPEAKER

HUI CHEN

Hui Chen received a forestry degree from China before coming to the University of Arizona to undertake a graduate program in the School of Natural Resources. She received a Master's Degree and currently is working on a PhD program. Her dissertation will focus on a geographically-references multiple-resource data management system for the oak savannas of the Southwestern Borderlands region. Parenthetically, she will be presenting a status report on this effort in the Hydrology Session later this afternoon.

BIOLOGY/ CHEMISTRY/ MATHEMATICS SESSION

SESSION: 8:00

ROOM: 313

Chairperson: Robert Bowker

8:00-8:20 MOLECULAR CLONING OF CORTICOTROPIN-RELEASING FACTOR RECEPTOR SUBTYPES FROM THE WESTERN SPADEFOOT TOAD, *SPEA HAMMONDII*

*Gagandeep Cheema and Graham C Boorse (Arizona State University, West Campus, Phoenix, AZ)

Western Spadefoot Toads (*Spea hammondi*) are desert dwelling amphibians whose late-staged tadpoles can accelerate metamorphosis as the desert pools dry, thereby escaping mortality in the larval environment. However, early-stage tadpoles exposed to habitat desiccation slow growth and development. Because corticotropin-releasing factor (CRF), the principal vertebrate stress neuropeptide, is believed to be responsible for mediating the changes in endocrine activity that drive environmentally-induced metamorphosis, we hypothesized that differential expression of CRF receptor subtypes within the pituitary can explain these stage specific developmental responses. To begin to better understand the role that CRF receptors play during environmentally-induced metamorphosis we have cloned cDNAs from *S. hammondi* brain that encode for CRF receptor type 1 (CRF₁) and type 2 (CRF₂) as well as the housekeeping gene ribosomal protein L8 (rpL8). Using reverse-transcription PCR with degenerate primers, we obtained partial cDNA sequences. The deduced amino acid sequence of each molecule shares considerable sequence similarity with its human ortholog: rpL8 (99%), CRF₁ (94%) and CRF₂ (91%). Full length sequences for the three genes as well as tissue specific and development expression for CRF₁ and CRF₂ are pending.

8:20-8:40 MOLECULAR CLONING AND CHARACTERIZATION OF CRF-LIKE PEPTIDES, RECEPTORS AND BINDING PROTEIN IN THE LIZARD, *ANOLIS CAROLINENSIS*

*Kevin L Svancara and Graham C Boorse (Arizona State University, West Campus, Phoenix, AZ)

Corticotropin-releasing factor (CRF)-like peptides modulate an organism's endocrine, autonomic, and behavioral responses to stress by binding and activating either of two G protein-coupled receptors (CRF₁ and CRF₂). At least four paralogous lineages of CRF-like peptides exist in vertebrates. Previous studies have characterized the CRF stress system across vertebrate taxa (e.g. fish, amphibians, bird and mammals). However,

squamates (lizards and snakes) remained unstudied. The stress system likely serves important roles in underlying common lizard behaviors such as dominance and territoriality. Using molecular cloning techniques, we have successfully isolated cDNAs for lizard CRF, urocortin 3 (UCN3), CRF₁, CRF₂ and CRF-binding protein (CRFBP). The deduced amino acid sequence of each molecule shares considerable sequence similarity with its human ortholog: CRF mature peptide (100%), UCN3 mature peptide (90%), CRF₁ (75%), CRF₂ (70%), and CRFBP (77%). An additional cDNA encoding a mature peptide that shares 61% identity with human CRF and 40% with human urocortin 1 (UCN1) was also identified. Using molecular phylogenetic analyses in conjunction with synteny mapping we have tentatively identified this molecule as lizard UCN1 rather than CRF. Tissue distribution of these genes via RT-PCR shows their expression is not localized only to nervous tissue but is expressed in many peripheral tissues as well.

8:40-9:00 EVALUATION OF ECOLOGICAL RECOVERY FROM FOREST FIRES USING ARTHROPOD COMMUNITY ANALYSIS

*Ryan Paulk, Jacob Higgins, Robert Delph, Neil Cobb (Northern Arizona University, Flagstaff, AZ)

Forest fires are frequent natural occurrences in arid regions which act to maintain healthy forests. The National Park Service and Forest Service have begun initiating forest health monitoring projects to evaluate forest recovery programs. In order to understand successional events that follow forest fires, burned and unburned areas of Mesa Verde National Park have been chosen to assess and compare arthropod community dynamics. Arthropods are an integral part in forest development as food sources, fertilization facilitators, and decomposers. Their sensitivity to changes in vegetation and habitat structure makes them an ideal organism for comparison between burned and unburned forest habitats. The objectives of the study were: (1) to identify important species indicative of recovering forests and (2) to identify differences in community dynamics, species richness and abundance, between burned and unburned habitats. Important indicator species were found correlating with guild and habitat composition. Arthropod community structure was different between burned and unburned sites with lower species richness and abundance in burned sites. Continued arthropod monitoring is essential to better understand post fire recovery sequences in forest systems.

9:00-9:20 MICRO-INVERTEBRATE COMMUNITY DYNAMICS ON ALGAE IN THE MID-INTERTIDAL ZONE ALONG THE NORTHERN GULF OF CALIFORNIA

Robert Delph, Stephen Shuster, Cody Brothers, Ryan Paulk, Gwynne Pollard (Northern Arizona University, Flagstaff, AZ)

Marine micro-invertebrate habitat selection is typically governed by surface area and food resource availability, especially in intertidal systems. Despite harsh conditions of intertidal zones, invertebrate communities flourish among the algae species which dominate these ecosystems. In this study we compared marine micro-invertebrate community dynamics of three co-dominate algae species: *Colpomenia tuberculata*,

Padina concrescens and *Sargassum johnstonii* along the mid-intertidal zone in the northern Gulf of California. We had two objectives; (1) determine differences in species composition, richness and abundance associated with 3 co-dominant algae species, and (2) identify specific taxa or guilds that are correlated with certain algae types. We predicted higher species assemblages on *Sargassum* sp. due to its complex surface area. Despite only one sampling period, differences in micro-invertebrate community composition were documented, with species richness and abundance higher on *Sargassum* sp. This study supports the notion that micro-invertebrates utilize algae species with higher complexity in surface area as habitat refuge. Thus *Sargassum* sp. makes up a larger component of the potential invertebrate habitat. Documenting community relationships of algae and their invertebrate hosts is fundamental to understanding the ecology of intertidal ecosystems and management of oceanic wildlife.

9:20-9:40 POTENTIAL COMPETITION AMONG ANT SPECIES IN OLD GROWTH PINYON-JUNIPER WOODLAND, MESA VERDE NATIONAL PARK

Jacob Higgins and Neil Cobb (Northern Arizona University, Flagstaff, AZ)

Ants can be important indicators of habitat quality and therefore useful in monitoring programs. The degree to which ants reflect habitat quality may be reduced by competitive interactions that mask habitat affiliations. For example, one species of carpenter ant may strongly reflect that amount of dead and down woody material only in the absence of a strong competitor. The goal of this study is to understand potential competitive exclusion among 25 ground-dwelling ant species by examining fine scale distribution patterns based on pitfall sampling. We tested for competitive exclusion through use of correlation analysis and spatial interpolation of pitfall data. We will also test whether combining suites of competing species actually account for more variation in habitat characteristics than using single species. The results of the study will greatly help refine monitoring programs being developed for National Park Service lands.

9:40-10:00 AN INTERIOR POINT ALGORITHM FOR LINEAR PROGRAMMING USING WEIGHTED ANALYTIC CENTERS

Shafiu Jibrin (Northern Arizona University, Flagstaff, AZ) and Julianne Anderson (University of North Carolina, Chapel Hill, NC)

This talk presents a simple interior point algorithm for solving linear programs that uses weighted analytic centers. We test its performance and limitations using a variety of LP problems. We also compare the method with the well-known logarithmic barrier method. The results are encouraging. The method found the optimal solution in each of the test problems. It seems to be faster but less accurate than the logarithmic barrier method.

10:00-10:30 COFFEE BREAK/POSTER SESSION: COURTYARD

10:30-10:50 COMPARISON OF CAVE ARTHROPOD COMMUNITIES IN CAVES WITH DIFFERING SUN EXPOSURES

Luke Hanna (Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ) and J. Judson Wynne (Merriam-Powell Center for Environmental Research, Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ)

We examined community composition and species abundance of two caves located on either side of a large canyon in Grand Canyon-Parashant National Monument. One cave has a south facing entrance, while the other cave entrance has a northerly aspect. These caves were once one large system separated by the incision of the canyon. Due to the juxtaposition of these two caves and the fact they were once connected, they present a unique opportunity for studying the differences in community composition and species abundance. Specifically, we investigated whether increased sun exposure, resulting in a lower humidity, would result in measurable differences between these two caves. We used data collected during 2005 and 2008. Arthropods were collected via baited pitfall trapping, and time-constrained and opportunistic searches. Environmental covariates examined include cave volume, insulation, relative humidity, and temperature.

10:50-11:10 A GEOMETRIC INTERPRETATION AND EXPLICIT FORM FOR HIGHER-ORDER HANKEL OPERATORS

Benjamin Pittman-Polletta (University of Arizona, Tucson, AZ)

Hankel matrices are constant along antidiagonals, and Hankel operators are operators that can be represented as finite or infinite Hankel matrices. This talk deals with well-known higher-order generalizations of Hankel operators. I will introduce a novel Lie-theoretic perspective from which to study higher-order Hankel operators. This perspective shows that higher-order Hankel operators can be written explicitly as compressed linear differential operators, and I will give the exact form of these differential operators.

11:10-11:30 SPECTROPHOTOMETRIC NITROGEN DIOXIDE ANALYSIS IN SMOKING AND NON-SMOKING LAS VEGAS AREAS

Prakriti Gaba (The Meadows School, Las Vegas, NV)

Pollution and consistent exposure to nitrogen dioxide is known as a factor in respiratory illnesses, such as pneumonia and emphysema, in Las Vegas, Nevada. Therefore, careful air monitoring of public areas is necessary. A convenient and cost-effective method uses passive diffusion tubes. These tubes, treated with TEA - a nitrogen dioxide absorbent, were placed in a non-smoking environment, The Meadows School in Las Vegas, for a control and smoking environments, which consisted of several small, neighborhood casino bars also in the Las Vegas area. After the tubes absorbed nitrogen dioxide from the designated environment for a week's time, they were analyzed with a series of chemicals and then tested spectrophotometrically. The results indicated that the

non-smoking environments had a nitrogen dioxide concentration of approximately 0.005-0.009 ppm, semi-smoking areas (the dining area of the pubs) had a nitrogen dioxide concentration of 0.013-0.014 ppm and the most smoky areas (the bar area of the pubs) had a nitrogen dioxide concentration of 0.025-0.036 ppm. This assay suggests that the amount of nitrogen dioxide present is directly correlated with the concentration of cigarette smoke in a given area.

11:30-1:30 LUNCHEON: COYOTE ROOM, PARK STUDENT UNION

GEOGRAPHY SESSION

SESSION: 8:30

ROOM: 115

Co-Chairpersons: Anthony Brazel and Soe Myint,

8:30 – 8:45 *KEY FACTORS INFLUENCING STORM-WATER QUALITY IN THE CITY OF PHOENIX

Min Jo Kang (Arizona State University, Tempe, AZ)

Urban areas face environmental challenges with the increase of impervious surfaces, which increase storm-water runoff. Polluted storm-water runoff has been identified as a main cause of water pollution. Storm-water pollutant concentrations from an arid environment, such as the city of Phoenix, have a tendency to be higher than those of humid environment because humid regions have more time to build up on impervious surfaces. The purposes of this research are to identify spatial distribution of estimated annual storm-water pollutants and to assess the important factors that potentially influence storm-water quality by rapid urban growth in the city of Phoenix. I focus on monitored storm-water pollutant concentrations of BOD5, TDS, TSS, phosphorous, oil and grease, copper, lead, and zinc at storm-event level. This research explains factors of storm-water pollutants with explanatory variables such as impervious surface, land-use type, vegetation cover, rainfall intensity, drainage area, and antecedent dry days using a multiple regression analysis. Increased imperviousness, industrial land-use, rainfall intensity, and antecedent day days and decreased vegetation cover cause increase in storm-water pollutants and the degradation of storm-water quality. This research can serve as a guideline for storm-water management considering urban environment and planning.

8:45 – 9:00 UNDOCUMENTED WASTE DISPOSAL SITES REVEALED BY DIGITAL ANALYSIS OF HISTORICAL AERIAL PHOTOGRAPHY

Robert A. Pope (Waterstone Environmental, Inc., Anaheim, CA)

A parcel of land (Parcel A) was known to have received acid sludge waste (ASW) from historic refining activities performed at a nearby refinery. Records and reports generated by decades of State and Local regulatory oversight indicated these ASWs were interred exclusively within the boundaries of Parcel A. However, photogrammetric analysis of the chronological sequence of historical aerial photographs indicated that the cumulative volume of ASW that was estimated to be interred at Parcel A was notably less than the volume of ASW reportedly generated by the refinery. To account for this discrepancy, additional stereoscopic photo interpretation of the chronological sequence of historical

aerial photographs was performed to discern if ASW disposal may have also occurred off-site. Photo interpretation revealed numerous relatively small, dark features (RSDFs) associated with a network of trails on the southerly adjacent property (Parcel B). Digital color substitution of gray scale was performed on select RSDFs to provide additional shading contrast for interpretation. Results revealed possible disposal pits (PDPs) throughout Parcel B. PDPs were mapped by GIS and staked in the field using GPS equipment. Surface manifestations of buried ASW were discovered at the ground surface at each PDP. Timely discovery of the ASW allowed for proper management of the Parcel B property within the pending environmental litigation case.

9:00 – 9:15 TEN YEARS OF EU REGIONAL POLICY EVALUATION: WHAT HAVE WE LEARNED?

Sandy Dall’erba (University of Arizona; Tucson, AZ), Maria Abreu (University of Cambridge, Cambridge, UK) and Henri L.F. de Groot (Vrije Universiteit, Amsterdam, The Netherlands)

This paper takes stock of the empirical literature that has investigated the effectiveness of European structural funds in promoting regional economic growth. This literature is clearly divided into studies that find a positive and statistically significant impact, and those which conclude that the funds have no statistically significant or even a negative impact. While we start with an evaluation of the existing econometric literature, we subsequently apply meta-analytic techniques to combine their results and get an objective answer: the funds do not significantly impact regional growth. Meta-regression analysis is then used to explain the variation in observed outcomes in the primary literature.

9:15 – 9:30 TEMPERATURE TRENDS IN THE SOUTHWESTERN UNITED STATES – 1950-2000: ARE CITIES WARMING FASTER?

Anthony Brazel and Hannah Mensing (Arizona State University, Tempe, AZ)

Sixty two weather stations with relatively complete monthly temperatures for the period 1950-2000 were analyzed for a region including the Mojave and Sonoran Deserts and parts of surrounding locations. Annual and June maximum and minimum monthly temperatures and annual extremes of temperatures were assessed. Two analyses were conducted: (a) determination of decadal rates of temperature changes and their statistical significance, and (b) determination of the time progression of record high and low temperatures during the length of record for selected sites with long records. Stations were grouped into large and small urban and rural sites, and population change of the 50 year period was determined for all sites. Results indicate a significant relation between the log of Population Change and high decadal rates of temperature changes in the Southwest US. Anomalies from this relation suggest other forcings of temperature change, such as alteration of land cover near urban and rural locales and synoptic time trends. The time array of record-breaking low and high temperatures appear to display strong urban effects as well as global change impacts.

**9:30 – 9:45 *MODELING HEAT-HEATH VULNERABILITY USING
REMOTELY SENSED DATA: A CASE STUDY OF CHANDLER,
ARIZONA**

Wen-Ching Chuang and Soe Myint (Arizona State University, Tempe, AZ)

This study examined how biophysical and lifestyle characteristics affect risk factors for heat-related morbidity (heat-related emergency 911 dispatches). Given a sample of heat-related calls measured on surface temperature, surface reflectivity (albedo), vegetation index, built-up index, and proximity to exposed soil, we developed regression models to predict the presence or absence of heat-related emergency calls. We employed a linear spectral mixture analysis based on a background removal approach to estimate soil endmember fraction at sub-pixel level. We selected the city of Chandler, which is located in the southeastern portion of the Phoenix metropolitan area and the 7th fast growing city in the U.S. as the study area. Vegetation index, surface temperatures, surface reflectivity, and man-made features were obtained from ASTER satellite systems. The analysis was conducted at different spatial scales (values of biophysical parameters within different local window sizes). The objective was to understand how heat-related emergency dispatches correlate with the above independent parameters. The statistical models were used to derive estimates of the odds ratios for each factor to enhance understanding of how urban morphology in conjunction with biophysical variables impacts human-health vulnerability to heat in arid and semi-arid regions.

10:00 – 10:30 COFFEE BREAK/POSTER SESSION: COURTYARD

**10:30 -10:45 * QUANTITATIVE ANALYSIS OF LANDSCAPE
FRAGMENTATION IN METROPOLITAN PHOENIX, USA,
FROM 1992 TO 2001**

Sainan Zhang, Soe W. Myint, Abigail M. York, Christopher G. Boone (Arizona State University, Tempe, AZ)

In the United States, metropolitan areas that exceed 10 million residents are well-established, and a trans-metropolitan geography is emerging and forming "megapolitan" areas. At the metropolitan fringe (including suburban and exurban areas), a mixture of urban and rural land-uses caused by urban sprawl has fragmented the landscape considerably. Since this landscape fragmentation has a potentially strong influence on the ecosystem, environmental quality, and society, it is essential to quantify the dynamics of urban land-use change in order to investigate its implications. Metropolitan Phoenix, Arizona, lies within the fastest growing megapolitan area known as the "Sun Corridor". The development of this urban area generates landscape fragmentation, especially in the low-density residential area of the suburbs. This paper explores the degree and spatial distribution of fragmentation in Metropolitan Phoenix from 1992 to 2001 by conducting a

series of spatial analyses of land-use patterns based on National Land Cover Datasets (NLCD). Landscape fragmentation metrics are used in this study to illustrate the degree of fragmentation, and the gradient analysis will present the spatial distribution of fragmentation. Appropriate land use planning, institution, and land-ownership may control urban sprawl, and reduce fragmentation of native habitats. The fragmentation metrics and gradients from this study will quantify the spatial pattern of urbanization, and provide a useful reference for further study when linked to land use institutions, public policies and social-ecological system.

10:45 – 11:00 MODELING PERENNIAL AND ANNUAL VEGETATION IN THE MOJAVE DESERT USING MODIS-EVI DATA

Cynthia S.A. Wallace, Kathryn A. Thomas, and Robert H. Webb (USGS, Tucson, AZ)

This study developed estimates of total perennial vegetation cover and a relative index of annual plant growth throughout the Mojave Desert, USA. To model the perennial cover, MODIS-EVI data were coupled with 447 measurements of total perennial cover and the elevation of each plot, using stepwise linear-regression techniques. To validate the models, we created 10 realizations of the final perennial cover models, each of which was trained using a random 80% subset of the field data and tested using the remaining 20%. The testing and training R^2 for these 10 realizations ranged from 0.62-0.83 and 0.79-0.85, respectively. The final models were used to create maps of perennial vegetation cover at 250-m resolution for the Mojave Desert. In contrast, the annual growth model was developed from MODIS-EVI data alone, with field measurements used to evaluate rather than to calibrate the model. We used landscape phenologies revealed in MODIS data together with expert knowledge of annual plant seasonality to develop a suite of metrics to describe annual growth on a yearly basis. Each of these metrics was applied to temporally-composited MODIS-EVI images to develop a relative model of annual growth. Each model was evaluated by testing how well it predicted field estimates of annual cover collected during 2003 and 2005 at the Mojave National Preserve. The best performing metric was the spring difference metric, which compared the average of three spring MODIS-EVI composites of a given year to that of 2002, a year of record drought. The spring difference metric showed correlations with annual plant cover of $R^2 = 0.61$ for 2005 and $R^2 = 0.47$ for 2003.

11:00 – 11:15 *DEVELOPING AND EMPIRICALLY TESTING A GREEN INDEX OF URBAN OPEN SPACES IN TEMPE

Won Kyung Kim (Arizona State University, Tempe, AZ)

This research provides an overview of a green index to measure the greenness of urban open spaces in an arid environment. This research delineates the types of urban open spaces, develops a green index, and tests empirically a green index in Tempe. There are various types of open spaces in the city of Tempe. Different types of urban open spaces

have clearly different types of vegetation cover and greenness. A “Green Index” is developed to understand the greenness of urban open spaces with the information of density and height for urban vegetation and forests through the analysis of high-resolution image and ground survey. There are three steps to produce a green index: 1) Data construction with remotely sensed data, 2) Ground truth for trees and shrubs, and 3) Production of a green index. This study provide simple green index calculated from the sum of the areas of trees, shrubs and grass divided by open space area. Additionally, three kinds of weighted green index are calculated with normalized difference vegetation index and tree weights. By giving weight with log NDVI, there is more difference between vegetated and non-vegetated areas. The value of 150m grids produced more interpretable results than that of open space units. Green index is a useful tool to quantify the greenness of urban open spaces in an arid environment.

11:15 – 11:30 OBJECT-BASED URBAN MAPPING

Soe W. Myint (Arizona State University, Tempe, AZ)

When dealing with high-resolution remotely sensed data for urban land cover mapping, traditional spectral-based image classification techniques have proven inadequate. An object-based classification approach that employs segmented objects in relation to different levels of scales as vital units was used to map urban land covers in the study. The selected land cover classes include buildings, roads and parking lots, unmanaged soil, trees and shrubs, grass, swimming pool, and other water bodies. A Quickbird image data acquired over Phoenix, Arizona on May 29, 2007 was used for the study. Some of the selected classes share the same or similar spectral responses that could lead to spectral confusion when using traditional per-pixel classifiers (e.g., maximum likelihood). For example, asphalt roads and asphalt parking lots share the same reflectance as asphalt rooftops. This is a similar situation for many other land covers: cement roads/parking lots vs. cement rooftops, asphalt roads/parking lots/rooftops vs. deep clear water, bright desert soil vs. bright impervious surfaces, and grass/active agriculture vs. shrubs. The object-oriented technique allows unlimited applicability of the classification system to other areas, requiring only the additional selection or modification of new objects until a satisfactory result is obtained. The successful use of the object-oriented paradigm largely relies on repeatedly modifying training objects, performing the classification, observing the output, and testing different combinations of functions as a trial-and-error approach. The availability of many different combinations of parameters, functions, features, and variables helped us identify urban land covers effectively.

11:30 – 1:30 LUNCHEON: COYOTE ROOM, PARK STUDENT UNION

GEOLOGY SESSION

SESSION: 8:30

ROOM: 240

Chairperson: Robert McCord

**8:30- 8:45 CHONDRICHTHYANS FROM THE PERMIAN (LEONARDIAN)
KAIBAB FORMATION OF COCONINO COUNTY, NORTHERN
ARIZONA**

John-Paul Hodnett, David K. Elliott and Tom Olsen (Northern Arizona University, Flagstaff, AZ)

Marine invertebrate fossils are well known from the Permian Kaibab Formation; however, few vertebrates have been noted and little systematic description has been attempted. Recently, collections have been made from urban outcrops at Northern Arizona University, Flagstaff Arizona, and nearby rural communities in Coconino County. With the addition of previous collections made by Museum of Northern Arizona staff in the early 20th century, these materials allow for the first systematic description of chondrichthyans (sharks and kin) from the Kaibab Formation. Identification is based largely on isolated teeth and spines. At present at least four taxa of “cladodont”, one taxon of “hybodont”, four taxa of “petalodont”, and four taxa of “cochliodont” tooth morphologies are recognized. Preliminary analysis of the fauna shows a modern trophic model with two ray-like *Janassa* species representing bottom dwelling invertebrate and vertebrate feeding specialists, ranging up to a large (size of a modern great white) “*Cladodus*” species as an apex predator. This fauna adds valuable information on the little known Permian sharks globally.

**8:48-9:03 THE FIRST RECORD OF A CAT (MAMMALIA, CARNIVORA,
FELIDAE) FROM THE CLARENDONIAN (LATE MIOCENE) OF
THE WALNUT GROVE FAUNA, MILK CREEK FORMATION,
YAVAPAI COUNTY, ARIZONA**

John-Paul Hodnett (Northern Arizona University, Flagstaff, Arizona) and Richard S. White (International Wildlife Museum, Tucson, AZ)

The Milk Creek Formation has yielded a diverse but under described Clarendonian (Late Miocene) fauna from central Arizona that has attracted museum collectors since the early mid 20th century. A small but significant collection was made by the Museum of Northern Arizona that includes the first specimens of a fossil felid. These specimens are a portion of the distal right humerus and portion of the right ulna. Measurements of the specimens suggest a felid roughly the size of a modern leopard. The Walnut Grove humerus is morphologically distinct from the nimravid (“false-cat”) *Barbourofelis* and

the Clarendonian/Hemphillian machairodont (saber-tooth) cat *Machairodus coloradensis* in the proportions of the medial epicondyle and development of the supracondyloid foramen. The humerus fragment compares best with the felid *Nimravides*. When compared by size, the Walnut Grove felid matches best with the humerus of *N. thinobates* rather than with other species of *Nimravides*, which are far larger. The ulna is morphologically more similar to *Nimravides* than to other felids and cat-like carnivores of the Clarendonian. We tentatively suggest the Walnut Grove felid be assigned to *Nimravides* cf. *thinobates* based on the available data. This is the first record of the felid *Nimravides* for the Clarendonian of Arizona and extends the biogeographic range of this taxon which is known primarily from Californian west coast, the great plains of Nebraska and Kansas, and Florida into the American southwest.

**9:08- 9:23 A REAPPRAISAL OF THE IDENTITY, STRATIGRAPHIC
POSITION AND AGE OF LATEST BARSTOVIAN (?) MAMMALS
FROM THE GRAYWATER WASH LOCALITY, APACHE
COUNTY, ARIZONA**

Richard S. White, Jr. (International Wildlife Museum, Tucson, AZ) and David D. Gillette (Museum of Northern Arizona, Flagstaff, AZ)

Vertebrate fossils collected in the 1950's by John F. Lance and Charles Reppening have been mentioned briefly in print and included in two summaries of Arizona fossil vertebrates. However, they have never been adequately studied. They have been identified as Clarendonian in age, and attributed to the Bidahochi Formation. Our examination of the most abundant taxon, a "merycodont" antilocaprid, suggests that it is best identified as *Cosoryx furcatus*, and that it most closely resembles the population of that species from the latest Barstovian Verdigre Quarry in Knox County, Nebraska. Other taxa present include at least two, but possibly 3 camels based solely on fragmentary postcranial materials, a questionable gomphothere, a canid represented by a complete lower dentition and a mustelid. The absence of horses and rodents from the fauna precludes a better assessment of its chronologic placement. The fossils were obtained from a reddish, silty, medium grained sand unit directly beneath a massive bentonite unit. This lies within a sequence of sands separated from the overlying Bidahochi Formation by an unconformity, and which deserves formation status. We are currently attempting to identify the original locality, verify the stratigraphy and collect additional specimens.

**9:26 -9:41 SURFACE FEATURES ON GASTROLITHS FROM A SHORT-
NECK PLESIOSAUR FROM THE TROPIC SHALE (UPPER
CRETACEOUS-EARLY TURONIAN) OF SOUTHERN UTAH**

David D. Gillette (Museum of Northern Arizona, Flagstaff, AZ) and Rebecca L. Schmeisser (University of Nebraska, NB)

Gastroliths found in direct association with a nearly complete skeleton a short-neck plesiosaur , *Dolichorhynchops* sp., from the Early Turonian Tropic Shale of southern Utah, are the first detailed record of stomach stones from the five taxa identified to date in this fauna. The 289 stones were exposed, numbered, photographed in place, and plotted on a quarry map. The well rounded stones are all dark chert in composition, with surface texture that varies from shiny to dull. All stones have pits, which vary stone to stone from prominent and abundant to subdued and rare. We postulate that these pits existed on the surfaces of the stones prior to ingestion by the plesiosaur and that the development of luster is a consequence of each stone's individual history in the digestive tract. Dull surfaces have the least modification of the surface pits, shiny surfaces have the greatest modification of the pits. By this argument, stones that had the greatest surface-to-surface contact with other stones would have the greatest departure from the original dull surface. In addition, most stones have scratches, grooves, and incomplete fractures that appear to be post-ingestion products of stone-to-stone contact, probably from muscular grinding in the digestive tract.

9:44 – 9:59 WHO IS *KINOSTERNON ARIZONENSE*?

Robert McCord (Arizona Museum of Natural History, Mesa, AZ)

The taxon, *Kinosternon arizonense*, was established in 1923 by Charles Gilmore on specimens collected from the Blacan NALMA Benson fauna, Cochise County, Arizona. Subsequently, *K. arizonense* was purported to be the senior synonym of *K. flavescens stejneri*, and a new combination, *K. flavescens arizonense* was proposed. Subsequent molecular phylogeny suggests an independent history for *K. flavescens*, and the extant "*K. arizonense*". But who is *Kinosternon arizonense* ? Recent collecting has resulted in many additional specimens of topotypic material as well as morphologically and temporally similar specimens from the 111 Ranch Beds of the Gila Conglomerate. The fossils differ from the extant specimens in several significant characters. Is *K. arizonense* extinct? It seems probable that the fossils represent a different species from the extant form and perhaps represent an independent history. The extant species might better be considered *K. stejneri*.

10:00 – 10:30 COFFEE BREAK/POSTER SESSION: COURTYARD

11:30 – 1:30 LUNCHEON: COYOTE ROOM, PARK STUDENT UNION

HYDROLOGY SECTION

SESSION I

ROOM: 102

Chairperson: Robert Lefevre

8:00 – 8:15 A BRIEF SUMMARY OF A REPORT BY THE NATIONAL RESEARCH COUNCIL ON THE HYDROLOGIC IMPACTS OF FOREST MANAGEMENT

Peter F. Ffolliott (University of Arizona, Tucson, AZ)

At the request of the U.S. Bureau of Reclamation and the U.S. Forest Service, the Water Science and Technology Board of the National Research Council convened a committee to study and report on the present status of forest hydrology science, connections between forest management, attendant hydrologic effects, and the consequent impacts on people; and future research and management needs to sustain water resources from forests. The study has been completed and the report, entitled “Hydrologic Effects of a Changing Forest Landscape,” was published by the National Academy of Sciences last year. This paper presents a brief summary of the report.

8:15-8:30 *A REVIEW AND ANALYSIS OF THE LITERATURE: THREATS TO RIPARIAN ECOSYSTEMS OF THE WESTERN UNITED STATES

K. Koestner¹, B. Poff², D.G. Neary¹, V. Henderson¹

(¹ US Forest Service, Rocky Mountain Research Station, Flagstaff, AZ

² National Park Service, Mojave National Preserve, Barstow, CA)

Over 440 journal articles, books and book chapters addressing threats to riparian ecosystems in the western US were analyzed in order to identify, quantify and qualify the major threats to these ecosystems. Publications were identified either as research, policy, literature review, historical comparison or management papers. While all papers were evaluated based on year of publication, location and types of threats, research papers were also sorted by length of study. The publications ranged from the 1960's to the present and addressed the following threats: dams, pollution (point and non-point), grazing, land use change, timber harvesting, water diversion, road construction, recreation, mining, groundwater pumping, invasive species, climate change, salinity, fire, insect and diseases, woody encroachment, watershed degradation, and elimination of native vegetation. While the types of threats vary on spatial and temporal scales, some

persist through decades in the entire western US. A detailed analysis and break-down of which threats predominate when and where will be presented.

8:30-8:45 *WATER REPELLENT SOILS FOLLOWING BURNING TREATMENTS AND A WILDFIRE ON THE CASCABEL WATERSHEDS IN THE OAK SAVANNAS OF THE MALPAI BORDERLANDS REGION

Cody L. Stropki, Aaron T. Kauffman, and Peter F. Ffolliott (University of Arizona, Tucson, AZ) and Gerald J. Gottfried (Rocky Mountain Research Station, Phoenix, AZ)

Water repellent soils impacts on the infiltration process by restricting the movement of water into the soil. As a result, much of the net precipitation falling onto the soil surface becomes surface runoff. Water repellent soils are often formed by the vaporization of organic matter and condensation of hydrophobic substances on mineral soil particles during fire. The intensity and extent to which water repellent soils formed on the Cascabel Watersheds located in the oak savannas of the Malpai Borderlands Region shortly following burning treatments and a wildfire is the focus of this paper. Some of the watersheds studied were burned by prescription in the warm-season and the cool-season, while other watersheds were burned by a wildfire. The occurrence of water repellent soils on these watersheds will continue to be monitored in terms of their spatial distributions and temporal changes to assess the impacts of the burning treatments on this soil parameter and the consequent hydrologic functioning of the watersheds.

8:45-9:00 SNOWPACK DYNAMICS IN A PONDEROSA PINE FOREST OPENING

Gerald J. Gottfried (Rocky Mountain Research Station, Phoenix, AZ) and Peter F. Ffolliott (University of Arizona, Tucson, AZ)

An important objective of forest management in the 1960s was to increase streamflows and productivity of forest lands. A silvicultural treatment designed to achieve these goals was conducted in the ponderosa pine (*Pinus ponderosa*) stands on the West Fork of Castle Creek, an experimental watershed in the Apache-Sitgreaves National Forests of eastern Arizona. One-sixth of the 900-acre watershed was harvested to create openings to improve stand conditions by removing groups of diseased and over-mature trees and the remaining area was thinned to remove high-risk, poor trees and to release potential crop trees. The hypothesis was that the openings would contribute to water yield improvement because of reduced evapotranspiration and because the differences in height between the residual stand and the openings would create aerodynamic forces that would result in increased snowpack accumulations. The treatment resulted in a significant increase in water yields from the watershed. The objective of this presentation is to examine the snowpack record for a typical irregularly-shaped opening of about 300 feet in diameter and to compare the results with those from an adjacent forested area where removals had been minimal. Records for five years are compared. Results are compared to meteorological records and to the historic Beaverhead Snow Course.

**9:00-9:15 *IMPACTS OF TREE HARVESTING IN RIPARIAN ZONES ON
STREAM SEDIMENTATION AND TURBIDITY: SCIENTIFIC
EXPERIENCE RELATIVE TO AUSTRALIA**

K. Koestner¹, D. Neary^{1,2}, P. Smethurst², and K. Petrone² (¹ US Forest Service, Rocky Mountain Research Station, Flagstaff, AZ ²CSIRO Sustainable Ecosystems, Hobart, Tasmania, Australia)

A typical improved-pasture property in the high-rainfall zone of Australia contains 0.5-2.0 km of waterways per 100 ha. Nationwide, some 25-30 million ha of improved pasture contains about 100,000 km of streams, of which about 75% are currently un-buffered and contributing to soil and water degradation. Farmers and natural resource managers are considering ways to enhance environmental outcomes at farm and catchment scales using streamside buffers of trees and other perennial vegetation. Benefits of buffers include improved water quality, biodiversity, carbon sequestration and aesthetics. Lack of sound information and funding for establishing and managing buffer zones is hindering wide-scale adoption of this practice. Stream-side areas of farms are generally highly productive (wet and nutrient-rich) and contain a high biodiversity, but they are also high-risk zones for soil and water values and stock safety. Development of options based on a balance between environmental and economic outcomes would potentially promote wider adoption. Australian codes of forest practice currently discourage or prevent harvesting of trees in streamside buffers. These codes were developed exclusively for large-scale native forests and industrial-scale plantations, and were applicable to farm forestry as now required. In countries including USA and Germany trees in stream-side buffers are harvested using Best Management Practices. Trees may grow at a faster rate in riparian zones and provide a commercial return, but the impacts of tree establishment and harvesting on water yield and quality must be evaluated. However, there have been few designed experiments investigating this problem. Australia has recently initiated studies to explore the use of high-value timber species and associated vegetation in riparian zones to improve water quality, particularly suspended sediment. Preliminary data from the Yan Yan Gurt Catchment in Victoria indicate that forested riparian strips can retain 98% of the sediment entrained in runoff from agricultural sections of the catchment. We examine the science background from North American and European experiences relative to Australia, with particular emphasis on sediment relationships after tree harvesting using Best Management Practices.

**9:15-9:30 *IMPACTS OF CLIMATE INSTABILITY ON FLOOD
MANAGEMENT DECISIONS ON THE RIO DE FLAG OF
FLAGSTAFF, ARIZONA**

Jamie Quisenberry (Northern Arizona University, Flagstaff, AZ)

Climate predictions for the Southwest indicate prolonged periods of drought, hotter seasons and increased storm intensity when it rains. These conditions can alter the fire regime and watershed characteristics of the Ponderosa Pine forest ecosystem in the area.

During periods of drought, Ponderosa Pines trees become weaker and more susceptible to bark beetle attack and eventual death and burning. The loss of forest cover would lead to an increased amount of runoff and flooding following intensive storm events that fall on the headwaters of the Rio de Flag. The main stem of the Rio de Flag passes through the City of Flagstaff inundating and causing damage to large areas of the City during heavy storms. The problems of flood hazard and its subsequent damage will be exacerbated by the haphazard rerouting of the Rio de Flag in the City of Flagstaff. This paper will explore the current and possibly unstable future climate and watershed conditions, analyze the City of Flagstaff's projected management plans and their respective impacts on the City, and suggest appropriate watershed management schemes.

9:30-9:45 THE EFFECTS OF CLIMATE CHANGE ON WATER RESOURCES IN THE MOJAVE NATIONAL PRESERVE

Boris Poff and Debra Hughson (Mojave National Preserve, Barstow, CA)

The Mojave National Preserve is located in one of the driest parts of the nation, with an annual precipitation ranging from two to six inches. More than 230 natural water sources sustain wildlife and often endemic biota. Global Climate Models generally agree that the drying trend in the desert southwest that is already under way will continue through the 21st century. Both, the duration and intensity of droughts is predicted to increase, as well as the proportion of precipitation that comes from extreme events. What is now considered a drought is likely to become the new norm. An increase in extreme weather patterns will exacerbate fire conditions and stress ecosystems. Understanding and maintaining resources through these changes is one of the great challenges facing resource managers. Monitoring efforts, preliminary results from the past four years, as well as, management options and implications are presented.

9:45-10:00 *WEIR REMOVAL AND RIPARIAN RESTORATION TO IMPROVE PARTS OF THE ISSEL RIVER IN NORTHWESTERN GERMANY

Silke Buschmann (Northern Arizona University, Flagstaff, AZ)

The northwestern regions of Germany and the adjacent regions of the Netherlands share a number of rivers and streams that originate in Germany and flow into the sea in the Netherlands. One of these rivers is the Issel (Dutch: Ijssel). On the German side, it is mainly used for agricultural irrigation purposes. Since the 1800s this river has been modified from its original meandering structure to a form that can support human needs better. One of the changes is installation of several weirs which have become harmful to the riverine flora and fauna, especially the native fish population. In recent years, extensive flooding of areas near the river has also become a major problem. This paper describes measures suggested to improve the structure and management of the Issel River to enhance the biodiversity along parts of the river. The suggestions include removal of

several weirs built without the necessary environmental assessment to find their effects on the ecosystem. Suggestions are also made to restore some of the riparian areas to as close as possible to their pre-disturbance conditions to ensure a stable recovery of the fauna and flora and enhance ecosystem diversity. Considerations about further use, financial availability, environmental issues, cooperation between two countries and the needs of the people living near the river will be a part of the proposed restoration plan.

10:00 – 10:30 COFFEE BREAK/POSTER SESSION: COURTYARD

Chairperson: Cody Stropki

10:30-10:45 *RESTORATION OF OAK CREEK WATERSHED: A HEURISTIC APPROACH

Rex Bergamini (Northern Arizona University, Flagstaff, AZ)

Oak Creek is an important stream that drains approximately 300,000 acres of the Oak Creek watershed. It is one of the few perennial waters in Arizona that has the dubious distinction of being classified simultaneously as “unique” and “impaired” water. The “impaired” designation is due to the presence of pathogenic bacterial indicators; specifically, *Escherichia coli* (*E. coli*). In spite of multiple funding efforts during the last 20 years to identify and mitigate the sources of the contamination, the problem has persisted, resulting in occasional closures of the recreational areas in the stream. Persistence of *E. coli* in the watershed is likely instigated from multiple sources, primarily wildlife but notably sediment agitation by recreational activity and storm surges, livestock, agricultural practices and possibly poorly functioning residential waste treatment and disposal methods. Persistence also suggests confounding effects of unidentified sources of coliform bacteria (source/sink populations) in the sediments of the Oak Creek. The situation warrants careful restoration at the watershed scale. In spite of the need, however, there are no comprehensive watershed restoration project plans for the Creek. This paper discusses the potential list of degrading factors requiring mitigation – including recreational, residential and wildlife sources of contamination, erosion and sedimentation problems, nonnative invasive species, agricultural impacts, groundwater removal, and anthropogenic structures that impact hydrology – for purposes of returning natural ecosystem structure and function to the Oak Creek watershed as based on natural range of variability benchmarks for potential reference sites. In addition, this discussion makes recommendations for developing a plan of action for restoring the Creek in a comprehensive, heuristic and adaptive manner.

10:45-11:00 *THE CASE FOR A SUCCESSFUL RESTORATION OF THE COMANCHE CREEK IN NORTHERN NEW MEXICO

Melanie Lawrence (Northern Arizona University, Flagstaff, AZ)

Located in the Valle Vidal area of the Carson National Forest in northeast of Taos, and spearheaded by the Quivira Coalition, the Comanche Creek project is aimed at restoring the aquatic habitat of a major head-water stream in the Rio Grande River basin. Past land uses including over-grazing and mining, coupled with improperly engineered roads and continued over-grazing by wildlife, have degraded this high-elevation stream basin. These have resulted in head-cutting, bank erosion, and habitat degradation for aquatic species such as the native Rio Grande Cutthroat trout (RGCT). The project was initiated to help improve these problems and restore the Comanche Creek. The restoration project involves creating the necessary conditions for re-establishing the above Forest Service designated indicator species as well as to create an opportunity for community-based groups to be involved in a holistic, socio-ecological watershed restoration process. Participants in the project include federal and state agencies, non-government organizations (NGOs), and local community and tribal groups working collaboratively in an adaptive management framework. The Quivira Coalition has successfully helped plan, implement, and monitor the entire process of the riparian restoration effort. This paper will elaborate on the efforts made, methods followed and the lessons learned from restoring the Comanche Creek.

**11:00-11:15 *ADDRESSING CHALLENGES TO ECOSYSTEM
MANAGEMENT IMPLEMENTATION FOR WATERSHED
RESTORATION**

Sabrina Kleinman (Northern Arizona University, Flagstaff, AZ)

Long-term sustainable management of watershed ecosystems requires participation by local, state, federal, private parties, and other interests. Also use of adaptive management has been proposed because ecosystems and their components are dynamic. Adaptive management helps to respond to changing conditions and adjustment to new management approaches. It can also help to address the varied opinions and expertise involved in restoring water resources systems to meet the needs of multiple interests. However, there are many obstacles that hamper the success and effectiveness of adaptive management. Obstacles may include institutional barriers, need for exhaustive planning, and the spatial and structural complexity of ecosystems. This paper explores how such obstacles may keep stakeholders from participating in the adaptive management process when managing watersheds such the Beaver Creek watersheds in northern Arizona. Use of adaptive management promotes use of a more comprehensive, widely supported, successful and efficient management system.

**11:15-11:30 ROLE OF DENDROCLIMATOLOGY IN WATER
SUSTAINABILITY IN SEMI-ARID REGIONS**

Ramzi Touchan and David M. Meko (University of Arizona, Tucson, AZ)

Careful planning and management of water and other natural resources in arid and semi-

arid environments require detailed information on the expectation of extreme events, such as prolonged drought. One needs to know the variability of local climate on time-scales of decades-to-centuries to better understand and prepare for drought conditions in these regions. Dendrochronology can provide the type of knowledge upon which to base sound decisions for water resources. Time series of tree-ring growth measurements spanning several centuries can serve as proxy records of past climatic conditions. Such records provide us with knowledge of the past frequency and severity of climatic anomalies, such as drought and wet periods, and can be used to help anticipate the future probability of such events. The objective of this paper is to describe how dendroclimatology has contributed to the understanding of drought recurrence in two widely separate semi-arid regions in the Northern Hemisphere. The first is Algeria and Tunisia in North Africa and the other is the Upper Colorado River Basin in the western United States. The results of these reconstructions are important in providing a decadal to multi-century perspective on climate variability to local managers of land and water resources. Given the significance of water in the region and its strategic importance, a clearer understanding of the return period and durations of drought could have considerable impact on both regions.

11:30 - 1:30 LUNCHEON: COYOTE ROOM, PARK STUDENT UNION

Session II

Chairperson: Gerald Gottfried

1:45-2:00 VARIETY OF ANTECEDENT RUNOFF CONDITIONS FOR RAINFALL-RUNOFF WITH THE CURVE NUMBER METHOD

Matthew R. Grabau (GeoSystems Analysis Inc., Tucson, AZ), Richard H. Hawkins, Donald C. Slack (University of Arizona, Tucson, AZ) and Kevin E. VerWeire (HDR Inc., Pearl River, NY)

The observed variation of event runoff from storm to storm for a given rainfall is often attributed to variation in ambient soil moisture. Thus, in the NRCS's Runoff Curve Number (CN) method three CN options are given depending on "Antecedent Moisture Conditions", or "AMC". These are: AMCI (i.e., low runoff, assumed "dry" conditions), AMCII (average, or the "reference" CN), and AMCIII (high runoff, assumed "wet" conditions). These choices were originally tied to 5-day prior rainfall. Using the AMCII as the reference CN for a given soil-vegetation complex, agency handbooks tables give CN values for AMCI and AMCIII. The origin of the tables is unknown and undocumented in NRCS sources. Later work by Hjelmfelt *et al* showed that these table CN relationships can be probabilistically aligned with observed (data-defined) CN values, or that the observed CNs could be well-described as random variables (conditional cumulative probabilities of runoff) at a given rainstorm depth, irrespective of their field moisture status. With 12 watershed and plot rainfall-runoff data sets from the midwest, the following cumulative probabilities ("less than") for runoff Q for a given

P based on the table CNs were found: Table AMC I as 10% of the observed occurrences, Table AMC II as 50% , and Table AMC III as 90% of the observed occurrences. With this finding, the NRCS redefined the AMC “moisture” classes as Antecedent *Runoff* Conditions, or ARC. This casts the table ARC classes as “error bands” which describe *all* the factors that influence variation in direct runoff from rainstorms, including site moisture. The prior choice criteria based on 5-day antecedent rainfall were dropped from NRCS procedures. However, the small sample size (12) and the local data left some doubt as to the generality of the findings. Here, using a much larger data set (N=114 watersheds) the general pattern given by Hjelmfelt *et al* is strongly supported, but the cumulative conditional probabilities of I, II and II are refined to 13.1%, 50%, and 88% respectively. Thus, about 3 out of 4 (75%) of all event runoffs (and observed CNs) are between ARCI and ARCIII. These findings give a probabilistic description to CN runoff calculation, and also affirm the general concept of the ARC classes as given in the agency handbooks.

2:00-2:15 DEVELOPMENT OF A RAINFALL-RUNOFF MODEL FOR BLACK CREEK WATERSHED, NAVAJO NATION

Aregai Tecele, Angie Garcia, Paul Heinrich and Diana Anderson (Northern Arizona University, Flagstaff, AZ), Gregg Garfin (University of Arizona, Tucson, AZ), John Leeper, and Jolene Tallsalt-Robertson (Navajo Nation, Department of Water Resources)

This paper is concerned with the development of a rainfall-runoff model for the Black Creek watershed in the Navajo Nation. The Black Creek watershed lies between the Defiance Plateau and the Chuska Mountains and drains the most populated part of the Navajo Nation in which the towns of Window Rock and Fort Defiance are located. Geographically, most of the study area, which receives about 10 inches of precipitation a year, is located in the semiarid part of the Colorado Plateau. We have two main purposes in developing the model. One is to determine the amount of runoff and peak flow generated from the 640 square mile watershed and the second is to provide the Navajo Nation a method for estimating water yield and peak flow in the absence of adequate data. The modeling effort consists of delineating the Black Creek watershed and obtaining the necessary biophysical and climate data from various sources. A GIS map that integrates spatial distributions of soil types, vegetation cover, land use, topography, precipitation and other watershed characteristics is developed. The spatial and other data from the watershed is imputed into a canned model known as Watershed Modeling System (WMS) to generate the amount of stream flow from the watershed. Model results are compared with actual measured stream flow data to determine model reliability and effectiveness.

2:15 – 2:30 AVERAGE ANNUAL WATER YIELD USING PRECIPITATION AND TEMPERATURE: GRUNSKY’S MODEL RECONSIDERED

Richard H. Hawkins (University of Arizona, Tucson, AZ) and Francisco L. Santos (University of Évora, Évora, Portugal)

Estimates of mean annual watershed water yield (surface water stream flow) are a fundamental need for a variety of hydrologic assessments. For ungauged watersheds, the usual approach is regionally developed regression equations that are a function of upstream area, precipitation, and temperature and other factors are commonly used. In this study the Grunsky relationship (ca 1908) is used as the beginning point for a generalized Mediterranean water yield expression based on long-term annual precipitation and temperature. The work here (1) generalizes and refines Grunsky's equation and its single parameter beyond the original presentation; (2) establishes temperature-dependence for Mediterranean (i.e., California) water yields, and (3) applies the validated model with independent testing to watershed data from both France and Portugal. The extension of the improved Grunsky approach to the European watersheds give results clearly aligned with California experiences. Insofar as it predicts water yield from precipitation, it also described on-site upland water use. It also can be used to examine the spatial and temporal variability for water yield and predict the effects of long-term climate changes at the regional scale.

2:30 – 2:45 RHEM MODEL APPLICATION FOR SOIL EROSION ASSESSMENT

Mariano Hernandez , Mark Nearing, Jeffry Stone, Haiyan Wei and Phil Heilman (USDA-ARS, Southwest Watershed Research Center, Tucson, AZ), Ken Spaeth (USDA, NRCS, Central National Technology Support Center, Fort Worth, TX)

This article describes an application of the Rangeland Hydrology Erosion Model (RHEM) to calculate runoff and erosion to NRCS National Resource Inventory Sampling sites. Simulations runs are focused on the evaluation of hydrologic and sediment response of states within designated ecological sites, which are the planning units through which NRCS recommends management decisions. Preliminary results in Arizona (Major Land Resource Area 41-3 for a Loamy Upland 12-16 inch precipitation zone) show that the difference in soil erosion rates can be documented between alternative stable states within ecological sites. Using this approach, it is possible to quantify the impact of conservation practices that directly impact vegetation and the corresponding impact/benefit it would have on surface hydrologic process and soil erosion rates of the site

2:45 – 3:15 COFFEE BREAK: COURTYARD

3:15 – 3:30 CREATING RESILIENCE IN WATERSHED STAKEHOLDER GROUPS THROUGH SOCIAL NETWORK ANALYSIS

Adam C. Springer and J.E. de Steiguer (University of Arizona, Tucson, AZ)

Watershed stakeholder groups are growing in number and influence as the increasing

concern for water quality, water availability and the sustainability of ecosystem services has inspired community engagement. Despite recognition of the importance of community participation in resource management initiatives, little is known about the structure and functionality of these groups. Social network analysis, a methodology which has been widely applied in numerous fields, has received relatively little attention in the environmental sciences. This case study applies this technique to two stakeholder groups in the Cienega Creek Watershed in southeastern Arizona. We find that social network analysis is a technique capable of providing significant insight into the complexities of community-based resource management activities. After being provided with this data, stakeholder groups report an increased resilience in responding to internal and external challenges.

3:30 – 3:45 *A GEOGRAPHICALLY-REFERENCED MULTIPLE-RESOURCE DATA MANAGEMENT SYSTEM FOR THE OAK SAVANNAS OF THE MALPAI BORDERLANDS REGION

Hui Chen, Cody L. Stropki, and Peter F. Ffolliott (University of Arizona, Tucson, AZ) and Gerald J. Gottfried (Rocky Mountain Research Station, Phoenix, AZ)

Twelve watersheds on the eastern side of the Peloncillo Mountains in southwestern New Mexico continue to be monitored to document ecological, hydrologic, and environmental characteristics of the oak savannas in the Southwestern Borderlands Region and determine the effects of burning treatments in this ecosystem. Physical components monitored include streamflow regimes, soil erosion and deposition, and sedimentation. Biological components including tree overstories, herbaceous understories, fuel loadings, and mammals and birds are monitored. Geographically-referenced data sets are incorporated into the system to facilitate spatial interpretations of the data sets and information.

3:45 – 4:00 EFFECTS OF GAMBEL OAK ON WATER HOLDING CAPACITY AND CARBON STORAGE WITHIN THE LITTER OF A PONDEROSA PINE-OAK FOREST

Robert E. Lefevre (USDA Forest Service, Coronado National Forest, Tucson, AZ)

A typical ponderosa pine forest in Arizona has a component of Gambel oak. The amount of water by weight and the length of time the litter beneath the stand can hold water after being saturated increases significantly as the oak component increases. Carbon storage in the surface layers of soil also increases with oak basal area. Natural resource managers considering ways to enhance moisture holding capacity of the forest floor and store carbon during times of uncertain climate changes and the desire to sequester carbon may well want to consider encouraging the Gambel oak component of their forests.

PSYCHOLOGY SESSION

SESSION: 8:20

ROOM: 316

Chairperson: Mende Davis

8:20-8:40 SELF-EFFICACY: THE STATE OF THE SCIENCE IN 2009

Amy H. T. Davis (University of Arizona, Tucson, AZ)

The purpose of this presentation is to provide a succinct overview of the self-efficacy theory and address common misconceptions, interpretations, and applications of the theory in the literature and to review the literature on self-efficacy theory from its roots in social cognitive theory to research and clinical applications for behavior change and health promotion. Given the vast amount of literature on self-efficacy, the challenge to clinicians and researchers is to clearly understand the theory of self-efficacy, to accurately evaluate this large body of literature, and to design programs and studies that advance the usefulness of self-efficacy theory for sustained adherence in behavior change and health promotion.

8:40-9:00 *A BRIEF HISTORY OF FOLK ART IN AMERICA: THE CONTESTED FATE OF A NEW GENRE

Holly Roggentine (University of Arizona, Tucson, AZ)

The history of folk art in America has been relatively short but surprisingly steeped in controversy. In a period of about a century, American folk art was discovered, collected through a picky lens of early-modernist aestheticism, memorialized as a quaint fad of the past, later rediscovered, approached from different viewpoints (i.e. fields of study outside art) and is, as of today, still being withheld from a general consensus about its definition and existence. A look at the progression of folk art interest and scholarship through the course of the twentieth century reveals that it has been surprisingly difficult for academics and enthusiasts to approach American folk art objectively. By examining a few of the more popular examples of written material on American folk art, I will demonstrate the kinds of changes afforded to the subject, including a shift along the continuum from connoisseurship to scholarship, and the staggering differences in opinion regarding the place of folk art in the broader spectrum of American art. To complicate matters even further, a shift from traditional themes to social awareness by folk artists of the later twentieth century has made the task of separating folk art from modern academic art quite problematical. The lack of agreement on a single and compact definition for American folk art has left its proponents divided on the issue of inclusion. A major debate in recent scholarship is whether all non-academic (i.e. not professionally trained) works of art should be included within the scope of folk art or whether limits based on

the presence of an artistic tradition should keep the genre relatively cullled.

9:00-9:20 *GPS TECHNOLOGY AND HUMAN PSYCHOLOGICAL RESEARCH: A METHODOLOGICAL PROPOSAL

Pedro S.A. Wolf & W. Jake Jacobs (University of Arizona, Tucson, AZ)

GPS technology is extensively used in the animal behavior literature. During the same time, the technology has become increasingly inexpensive and has become an almost omnipresent, found in vehicles and cellular phones. This form of technology has been underused in psychological research - despite the obvious potential uses of this technology for research. We describe several methods that can be used in the context of human psychological research and provide examples from our own research experience with this technology. The methods we outline include may be applied to individual differences research, clinical research, and spatial utilization research. In the context of individual differences research, GPS technology permits us to test hypotheses that predict specific relations between spatial utilization patterns and individual differences variables. In the clinical context, GPS technology provides outcome measures that may relate to the successful or unsuccessful treatment of a psychological disorder that, for example, leaves the patient homebound (e.g. Agoraphobia, PTSD). Finally, GPS technology provides natural measures of spatial utilization. For example, we are characterizing the spatial patterns and exhibit use at the Arizona Sonoran Desert Museum – with the object of improving both traffic flow and the use of the exhibits. We can easily extend this methodology to characterize road utilization in the context of urban planning.

9:20-10:00 BAYESIAN MIXTURE MODELING FOR CLINICAL DECISIONS

J. Michael Menke (University of Arizona, Tucson, AZ)

How may we compare two or more therapies or systems of care without setting up a giant expensive clinical trial? Clearly, randomized controlled clinical trials (RCTs) set the standard for scientific and clinical investigation, but they are expensive and resource intensive. Instead, there may be an intermediate step that indicates a current state of the clinical science, and even helps us decide if future research is indicated. Tools and assumptions include distribution-free Bayesian methods, the Likelihood Principle, and affixing estimated costs of using an ineffective treatment or failing to use an effective treatment. Two primary tools are used: WinBUGS Bayesian and TreeAge software. An example will test the most effective method of smoking cessation across 47 studies. An explanation and rationale will precede the demonstration and interpretation of findings.

10:00 – 10:30 COFFEE BREAK/POSTER SESSION: COURTYARD

**10:40-11:00 PREDICTIVE MODELING IN MUSCULAR DYSTROPHY:
IDENTIFYING THE NEED FOR CARE**

Melinda F. Davis, Jennifer Andrews, Shawnell Damon, Rebeca Arias, Timothy Miller, F. John Meaney and the Palliative Care Group MD STARnet. (University of Arizona, Tucson, AZ)

In progressive conditions, the need for care increases over time. Use of services may not keep pace with the need for services. Multivariate modeling will be used to characterize unmet need in muscular dystrophy and to evaluate potential reasons for these gaps. Predictors include characteristics of the individual (disease progression, age), family characteristics (family resources, attitudes) and other indicators, such as the availability of services. If the use of palliative care is based on need and is freely available, the individual characteristics should account for all of the variance. Methods: Structured telephone interviews were conducted in a multi-state study. The interview included family characteristics, disease progression and use of services. The sample included 34 caregivers. This presentation will demonstrate several data aggregation techniques that are useful in small sample research.

**11:00-11:20 A SOCIAL RELATIONS MODEL FOR THE COLONIAL
BEHAVIOR OF THE ZEBRA FINCH**

Aurelio José Figueredo (University of Arizona, Tucson, AZ)

A social relations model was developed for 5 years of behavioral recordings from a captive colony of Zebra finches (*Taeniopygia guttata*). A quantitative ethogram was applied, using one-zero focal animal sampling on an ethologically comprehensive checklist of 52 behavioral items (Figueredo, Petrinovich, & Ross, 1992). Of the 9 ethological factors previously identified, only the 4 of the 6 social factors (Social Proximity, Social Contact, Social Submission, Social Aggression) were used. Major results were as follows: (1) Individual finches showed systematically different response dispositions that were stable over 5-year period as both subjects and objects of behavior; (2) Interactions between finches differed systematically by the sexes of both the subjects and the objects of behavior; (3) Behavioral interactions between finches and their mates differed systematically according to the subjects' sex, but also differed systematically from those with other members of the objects' sex; (4) Behavioral interactions between finches and their relatives differed systematically between different discrete categories of relatives, but did not vary as a systematic function of either graded genetic relatedness or familiarity due to common rearing; (5) Behavioral interactions between finches and their relatives showed an overall bias towards preferential interactions with male relatives.

11:30 - 1:40 LUNCHEON: COYOTE ROOM, PARK STUDENT UNION

POSTER SESSION

SESSION **10:00-10:30**

ROOM: **Courtyard**

Chairperson: **Erik Gergus**

WATER CONTAMINATION: MICROANALYSIS DETERMINATIONS AND SOLAR REMEDIATION OF VOLATILE ORGANIC COMPONENTS

Jeffrey J. Rosentreter, (Idaho State University. Pocatello, ID)

Determination of aqueous volatile organic compounds (VOC) such as trichloroethylene (TCE) continues to be a pressing challenge. TCE and other VOC's are well documented and strictly controlled environmental toxins, which exhibit carcinogenic properties. Several possible analytical methodologies for the micro-scale analysis of these compounds are available, including direct aqueous injection, purge and trap, and headspace. A new methodology using solid-phase micro-extraction (SPME) and routine gas chromatography/mass spectrometry (GC/MS) has been developed in our research group. The newly developed SPME method has incorporated many analytical advantages, such as minimized analysis time, low analysis cost, as well as high precision and accuracy all with excellent environmental stewardship. The use of SPME allows for detection of TCE below 5 ppm, without external preconcentration steps. Once quantified these substance need to be mitigated. The use of dye sensitized semi-conductor solar photocatalysts, have been shown to be effect, but difficult to implement. By coupling these catalysts to buoyant ceramic spheres, it will be shown that an environmentally sound remediation method can be created.

DIHYDROTESTOSTERONE ALTERS ENDOTOXIN AND CYTOKINE INDUCED INCREASES IN CYCLOOXYGENASE-2 BUT HAS NO EFFECT ON PROSTAGLANDIN E₂ LEVELS IN HUMAN CORONARY ARTERY SMOOTH MUSCLE CELLS.

Kristen L Osterlund^{1,2}, Anthony Gutierrez¹, Robert J Handa^{1,2}, Rayna J Gonzales¹
(¹University of Arizona College of Medicine - Phoenix, AZ, ²Colorado State University, Fort Collins, CO)

Clinically, both protective and non-protective effects of androgens on the cardiovascular system have been reported. In addition, past studies have demonstrated that androgens modulate proinflammatory mediators in vascular tissues both under normal conditions and following induction of inflammation. Our previous studies show that chronic testosterone treatment exacerbates endotoxin-induced cyclooxygenase-2 (COX-2) levels

in cerebral arteries isolated from rodents. Here we investigated whether dihydrotestosterone (DHT; 10-100nM), the more potent androgen receptor agonist, modulates COX-2 and prostaglandin E₂ (PGE₂) levels in primary human coronary artery smooth muscle (HCASM) cells following stimulation with lipopolysaccharide (LPS; 100µg/ml) or interleukin 1 beta (IL1β; 5ng/ml). IL1β and LPS increased COX-2 levels compared to vehicle at 3, 6, 9, 12 hr time points. In addition, DHT (10-100nM) slightly increased COX-2 levels compared to vehicle and this response was dose dependent. Interestingly, LPS-induced increases in COX-2 were blunted when co-administered with DHT, while IL1β-induced increases in COX-2 were only slightly decreased by DHT. Conversely, DHT had no effect on PGE₂ levels whether administered alone or in the presence of cytokine-induced inflammation. In conclusion, DHT may differentially modulate COX-2 levels without affecting PGE₂ production under normal conditions or following cytokine or endotoxin induced inflammation in HCASM cells. *Support: AHA SDG RG*

EFFECTS OF DEPENDENCY AND EXAM ITEM FORMAT ON EXAM PERFORMANCE

Steven C. Funk, K. Laurie Dickson (Northern Arizona University, Flagstaff, AZ)

This experiment tested the dependency hypothesis of student learning with respect to multiple choice exams. We hypothesized that students become overly dependent on multiple choice formatted items, and that they become overly dependent on keywords contained within exam items. Because multiple choice items provide the correct answer, we hypothesized that students would study enough for recognition and not for recall of information. The presence of keywords encourages students make few connections or memory nodes between concepts and their meanings. Students were randomly assigned to receive a ten item short answer test either before or after a larger multiple choice exam. The ten short answer items had identical wording to ten multiple choice items imbedded within a larger multiple choice test. We found that students had significantly lower scores on the short answer items when compared with scores on the same items within the multiple choice exam. Short answer post test performance was higher than short answer pretest performance, suggesting that students used information provided by multiple choice answers to complete short answer post test items. Results were replicated in a later exam that reversed participants' assignment to the short answer pretest-posttest conditions. In a test of keyword dependency, students also performed significantly better on items that contained keywords than on items in which a synonym was substituted for the keyword. Administration of two alternate exam forms in which keyword-present and keyword-substituted items were reversed showed that the result was not a function of item content. These results expand the applicability of the dependency hypothesis to include two widely used exam formats.

RESTORATION (OR NOT) AT MOJAVE SPRINGS

Annie Kearns and Boris Poff, (Mojave National Preserve, Barstow, CA)

In the Mojave Desert, where nearly every spring source has been altered, even the definition of “spring” is open to debate. Early settlers sought to access more water than available at the surface for purposes which included ranching, mining, homesteading, farming, and transportation. After two seasons of inventory surveys, we conclude that most springs in Mojave National Preserve represent small perched zones interfacing with the surface near the bottom of canyons. After decades of diversion many spring developments have fallen into disrepair and/or abandonment. Years of draining water from perched storage may have caused water depletion and drying at many springs. Evaporation and transpiration remove an unquantified volume of water from these sites, too. With the ongoing inventory 2/3 complete, over 30% of springs appear dry. Ranchers have moved away from the Preserve and dismantled their water systems; wildlife now relies more on the springs than they have in decades. Important questions about regarding spring recovery and restoration. What does spring “restoration” mean if plants will fill the site and use up any surface water? Should our target be to “restore” or to “manage” for surface water? How can a restoration goal be identified if the original condition is unknown? Will a passive approach accomplish the recovery goal? We hope to stimulate discussion and interest among the scientific community regarding these timely questions.

***DISCOVERY OF NOVEL CARDIAC VITAMIN D RECEPTOR INTERACTING PROTEINS (VIPs): THE ROLE OF VITAMIN D AS A MEDIATOR OF HEART HEALTH**

Zach J. Hernandez, Tim A. Widener, Pamela A. Marshall and Peter W. Jurutka (Arizona State University, Phoenix, AZ)

The nuclear vitamin D receptor (VDR) modulates gene transcription in 1,25-dihydroxyvitamin D₃ (1,25D) target tissues such as kidney, intestine, and bone. VDR is also expressed in heart, and recently 1,25D was shown to normalize impaired heart contractility. This study was designed to identify proteins expressed in heart tissue that interact with VDR, and potentially modify receptor activity, by using the yeast two-hybrid system and a human heart expression library. Employing this system, we identified 5 candidate VDR interacting proteins (VIPs) in a 1,25D-independent screen, including CXXC5, FASTK, NR4A1, TPM2 and ORAI3. We also discovered a 1,25D-dependent VIP, XIRP1, a protein involved in cardiac morphogenesis and stabilization of the actin-based cytoskeleton. GST-based pulldown assays are being utilized to confirm that each protein can interact with VDR, *in vitro*, and preliminary data demonstrate that CXXC5 displays a robust affinity for VDR. In addition, potential modulatory effects of these VIPs on VDR activity are being tested in transcriptional assays employing a vitamin D responsive element-driven luciferase reporter vector in transfected Caco-2 and

HEK-293, cell lines that represent vitamin D target tissues. In this assay, FASTK and TPM2 moderately enhanced VDR-mediated transcription in both cell lines, while CXXC5 weakly stimulated transcription in Caco-2 and repressed it in HEK-293. C2C12 cells will also be used to test the functional role of VIP interactions, thus utilizing a myoblast cell line as a model system. Identification of novel heart VIPs and their impact on VDR activity may facilitate development of VDR/VIP drug analogs to combat heart disease.

***REGULATION OF THE ANTI-AGING GENE KLOTHO BY 1,25(OH)₂D**

Christine Lowmiller, Peter W. Jurutka (Arizona State University, Phoenix, AZ), G. Kerr Whitfield and Mark R. Haussler (University of Arizona, Phoenix, AZ)

Klotho (*kl*), a gene expressed in the kidney, is linked to suppression of multiple age-related phenotypes. One function of the klotho protein (KL) is to act as a coreceptor for the fibroblast growth factor 23 hormone (FGF23). KL binds directly to the FGF receptor (FGFR) in the kidney creating a KL/FGFR complex that is required for binding by FGF23. Both *fgf23* or *kl* null mice are unable to excrete phosphate, and develop hyperphosphatemia with numerous premature aging-like phenotypes. Hyperphosphatemia is likely due to the action of 1,25 dihydroxyvitamin D (1,25(OH)₂D) which stimulates both phosphate absorption through the intestine and reabsorption in the proximal convoluted tubule (PCT). FGF23, which is upregulated by 1,25(OH)₂D via the vitamin D receptor (VDR), simultaneously acts in a negative feedback loop to halt the synthesis of 1,25(OH)₂D and to decrease phosphate reabsorption in the PCT. Both FGFRs and VDRs are located in the PCT, yet *kl* expression has not been reported in this area of the nephron. However, we suspect that *kl* is expressed in the PCT since this is where phosphate reabsorption occurs. We hypothesized that 1,25(OH)₂D, acting via VDR, upregulates *kl* in the kidney to allow phosphate excretion. Primers were designed to recognize the rodent *kl* transcript. Real-time PCR data showed a moderate (1.5-fold) upregulation of *kl* mRNA by 1,25(OH)₂D in mouse inner medullary collecting duct cells, with the effect nearing statistical significance (P=0.058). Future experiments will include the use of a more pertinent cell line HK-2 (human PCT) and an investigation of *kl* gene regions for vitamin D receptor binding sites.

***BIOLOGICAL EVALUATION OF NOVEL BEXAROTENE ANALOGS FOR THE TREATMENT OF CUTANEOUS T-CELL LYMPHOMA**

Julie K. Furmick, Carl E. Wagner, Pamela A. Marshall and Peter W. Jurutka (Arizona State University, Phoenix, AZ)

Retinoids, a class of compounds derived from vitamin A, can be used clinically to treat a variety of skin disorders and certain cancers. One type of retinoid, 9-cis retinoic acid (9-cis RA), binds to the nuclear retinoid X receptor (RXR) and induces RXR homodimer formation and RXR-mediated transcription. Bexarotene (Bex) is a synthetic ligand modeled after 9-cis RA that is indicated for treatment of cutaneous T-cell

lymphoma (CTCL). When bound to Bex, RXR forms homodimers and modulates the expression of 9-cis RA target genes. However, Bex can also dysregulate other RXR requiring pathways. Therefore, we sought to model and synthesize novel analogs of Bex that bind RXR and mediate regulation of anti-tumor genes, without disrupting other RXR pathways. We tested 19 analogs for their ability to trigger RXR homodimerization, and for their capacity to induce binding of the receptor to an RXR DNA responsive element (RXRE) via both a mammalian two hybrid system and an RXRE-mediated transcriptional assay, respectively. Four of the analogs mediate RXR transcription ranging from 20% to 100% of Bex activity. These 4 analogs will be tested for their ability to influence the transactivation of other receptors utilizing RXR as a heterodimeric partner. In addition, the analogs will be tested in apoptosis and cellular cytotoxicity assays using a CTCL cell culture model, and gene microarray technology will be employed to compare expression profiles relative to Bex. The results from these approaches may lead to discovery of novel RXR analogs that will inhibit antiproliferation pathways in cancer cells.

***TELOMERASE REGULATES REPEAT ADDITION PROCESSIVITY THROUGH BINDING AND RELEASING RNA/DNA HETERODUPLEX**

Mingyi Xie¹, Joshua D. Podlevsky¹, Xiaodong Qi¹, Christopher J. Bley¹ and Julian J-L Chen^{1,2} (¹Department of Chemistry & Biochemistry, ²School of Life Sciences, Arizona State University, Tempe, AZ)

The telomerase enzyme is minimally composed of a catalytic protein and an intrinsic RNA moiety serving as template. Within most species, the enzyme has adapted to synthesize multiple telomere repeats before complete dissociation of products. The processive action of telomerase relies upon a unique template translocation event whereby the RNA template and the telomeric DNA dissociate and realign after each repeat synthesis. However, the detailed mechanism and structural elements enabling template translocation have remained elusive. We have identified a novel motif, named motif 3, that is conserved specifically within species exhibiting processive telomerase. Comprehensive mutational screening of motif 3 revealed distinctive phenotypes, indicating separate steps of template translocation are affected by this motif. Several mutations within this motif severely reduce processivity. By using a template-free human telomerase that consists of TERT and essential RNA elements, we show that telomerase recognizes the RNA/DNA duplex as substrate, but not the single-stranded DNA or RNA. Duplex recognition resembles the final repositioning step of the template translocation event. Our data shows that reduced affinity to duplex is responsible for the reduced processivity observed in motif 3 mutants. Additional mutants, interestingly, exhibited a higher repeat addition rate resulting from faster dissociation of the heteroduplex, the initial step of template translocation. Therefore, motif 3 is crucial for telomerase processivity by regulating both dissociation and repositioning steps of RNA template translocation. The conservation of this motif between such diverse groups as vertebrates and ciliates suggests that the motif 3-dependent mechanism for template translocation, in addition to processivity, is evolutionarily ancient.

ACADEMY BUSINESS AND ANNUAL REPORTS

OFFICERS 2008 - 2009

ELECTED

Robert Reavis	President
Robert McCord.....	President Elect
Pamela Marshall	Membership Secretary
Pedro Chavez.....	Permanent Secretary
Karen Conzelman	Treasurer
Philip Rosen.....	Director, Southern Arizona
Erik Gergus.....	Director, Central Arizona
Shafiu Jibrin.....	Director, Northern Arizona
Barbara Adams.....	Director, Nevada

APPOINTED

Anthony Brazel.....	Editor, Journal
Florence Slater.....	Editor, Proceedings
Alison Waterkotte.....	Science Olympiad/Science Bowl Liaison
Michael Menke.....	Editor, Newsletter
Boris Poff.....	Webmaster

SECTION CHAIRS

Robert Bowker.....	Biology
Anthony Brazel and Soe Myint	Geography
Robert McCord.....	Geology
Peter Ffolliott and Robert Lefevre.....	Hydrology
Shafiu Jibrin.....	Mathematics
Erik Gergus.....	Poster Session
Melinda Davis	Psychology

COMMITTEE ROSTER

BUD ELLIS SCHOLARSHIP

Stephen M. Shuster

PROGRAM

Peter Ffolliott

MEMBERSHIP

Pamela Marshall

NECROLOGY

Pamela Marshall

OUTSTANDING SCIENCE TEACHER

William Perry Baker

BUDGET

Karen Conzelman

OUTSTANDING SERVICE AWARD

Anthony Brazel
Karen Conzelman
Betsy Cooper
Sandra Wardwell
Stephen Williams

BEST STUDENT PAPER

Robert Reavis

GRANTS-IN-AID

Aregai Tecle

BEST STUDENT POSTER

Erik Gergus

PRESIDENT'S REPORT

The academic year of 2008-2009 has been a year of change! The ANAS Board of Governors underwent the largest change in membership in at least a decade; seven officers are serving their first terms on the board. Similarly, our nation has had a dramatic change in leadership that includes renewed support for the enterprise of science and appreciation for the results of scientific endeavors.

Our transition to an online journal is nearly complete, thanks in large part to the efforts of Owen Davis, Perry Baker, Buck Jones, and Cindy Zisner. Current issues of *JANAS* are online with BioOne. In September, BioOne joined with Publishers Communication Group (PCG) - a marketing company that will interface with libraries and further the circulation of its journals, including *JANAS*. Older issues of *JANAS* have been archived with JSTOR and digitization has been completed. After some additional testing between BioOne and JSTOR, *JANAS* should be accessible online in its entirety by July 2009. JSTOR provides inexpensive access to 553 journals. Benefits of ANAS membership include your subscription to *JANAS* as well as reduced page charges for articles published in *JANAS*. All members will still receive a paper copy of the journal for now, although an online-only option may be available soon. BioOne and JSTOR greatly increase the circulation of our journal. They also pay royalties and will ultimately reduce our printing charges.

Along with these changes have come some challenges. Our new officers have worked to transition to a new website and to deliver announcements, newsletters and membership reminders electronically. However, in 2008 there was a delay in the announcement and collection of membership dues while these changes took place. Thus, membership renewals dropped significantly last year. Thanks to our new Membership Secretary, Pamela Marshall, and Web Master, Boris Poff, membership renewals for 2009 are trending back up. Your membership dues pay for the majority of our activities. If you have not renewed for 2008 or 2009, please make a payment today. You can pay in person! Or go online: <http://www.arizonanevadaacademyofscience.org/php/elecdues.html>

The current economic problems provide additional challenges and opportunities. While federal funds may be increased in the near future, state-funded colleges and universities have already experienced significant cuts. These budgetary changes impact research and the ability to meet with colleagues at scientific meetings. Fortunately, as a regional organization, our annual meeting is very cost effective. Transportation costs are low and registration is inexpensive – particularly for students. Moreover, we welcome scientists of every discipline. Let your colleagues know about ANAS!

Finally, I would like to thank our hosts for making this meeting possible, particularly Peter Ffolliott, Cody Stropki and the University of Arizona. Thank you!

Robert H. Reavis
President

MINUTES

of the annual business meeting
and awards luncheon
MARCH 29, 2008

After a very interesting luncheon presentation by the Arizona Game and Fish Department's wildlife disease specialist Lisa Shender, DVM about Chronic Wasting Disease in deer and elk populations, the annual Business Meeting of was called to order by Permanent Secretary W. Perry Baker at 12:50 pm. Other members of the Board of Governor members in attendance: Karen Conzelman, Boris Poff, Robert Reavis, Florence Slater, and Aregai Teclé

Brent Garrison, President of Southwestern College, warmly welcomed the group to his campus.

Permanent Secretary Baker directed the membership to review the minutes of the 2007 meeting printed in their copy of the Proceedings; they were approved as written. Reports from other officers were also noted.

After some discussion, the revision of the By-Laws to read as follows was approved:

5.00 -- OFFICERS

5.10 -- The officers of the Academy, who also constitute the Board of Governors, shall be the President, President-elect, Past President, Recording Secretary, Membership Secretary, Treasurer and four to five regional Directors, The Editor of Journal, The Editor of the Newsletter, The Editor of the Proceedings, The Permanent Secretary, and The Webmaster.

5.11 -- One director shall be chosen from each of the four geographical regions of Southern Arizona, Central Arizona, Northern Arizona and Nevada.

5.12 -- An additional fifth director will be chosen from anywhere in Arizona or Nevada as needed.

5.20 -- The Recording Secretary, Treasurer, and Membership Secretary shall hold office for one year and the Directors shall hold office for two years. They shall be elected by ballot at the Annual Meeting and shall hold office until a successor is elected.

5.21 -- The President-Elect, President and Past President shall hold office for two years, or until replaced by their successors.

5.22-- The President-elect shall automatically become President at the convening of the Annual Meeting at which a new President-elect is chosen. Subsequent to that election the President-elect shall take over as President and the retiring President shall automatically become Past President.

As per the stipulations of the Academy's By-Laws, these changes had been proposed to the membership for their consideration in the January newsletter.

Perry Baker introduced the Outstanding Middle School Teacher, Shawn Lent, from Western Peaks Elementary School in Surprise, AZ. He was presented with \$50 honorarium and a plaque.

Next Soe Minyt from the Geography Department at ASU introduced Anthony Brazel

and, on behalf of the Academy, presented him with a plaque and honorarium as the ANAS' Outstanding Service Award winner for 2007-2008. Tony's service to the Academy dates back at least 15 years to his first terms as Central Arizona Director and continues to this day as Editor of the Journal of the Arizona Nevada Academy of Science (JANAS).

Steve Shuster recognized three Honorable Mentions and two Bud Ellis Scholarship recipients selected for this year from among the 28 stellar high school students who submitted applications for the award. The winners were Jillian Moore from Mountain Ridge High School in Glendale, AZ and Mary Schmidt from North Canyon High School in Phoenix. Only Jillian was able to join the group for the luncheon; she was presented with a certificate and congratulated by the membership in attendance. Mary's certificate will be sent to her with our accolades on her outstanding achievements. One thousand dollar scholarships will be sent to the University of Arizona and Arizona State University respectively to be used towards their educational expenses.

The following additional by-law changes (inadvertently overlooked earlier in the agenda), updating the responsibilities of the Membership Secretary and the Treasurer, were approved by the acclamation.

6.50 -- MEMBERSHIP SECRETARY

6.51 -- The Membership Secretary shall keep a record of the membership of the Academy and shall, upon request supply Section Chairs with a list of the names and addresses of section members.

6.52 -- The Membership Secretary shall prepare and mail notices of dues and shall keep a record of the dues paid by the members.

6.53 -- The Membership Secretary shall prepare and mail renewal notices to all institutional subscribers to the Journal of the Arizona-Nevada Academy of Science and shall keep a record of fess paid.

6.54 -- The Membership Secretary shall provide mailing labels to the Newsletter Editor for mailing of the Newsletter and to the Editor of the Journal for mailing of the Journal.

6.55 -- The Membership Secretary shall send copies of recent issues of the journal to members and libraries that did not receive their copy with the regular mailing.

6.56 -- The Membership Secretary shall have charge of mailing copies of the Bylaws and current list of the officers of the Academy to new members and to prospective members who request them.

6.57 -- The Membership Secretary shall in December, present to the Board of Governors a report on the current membership of the Academy.

6.60 -- TREASURER

6.67 -- The Treasurer shall see that appropriate tax forms are filed with the IRS.

Recipients of the Outstanding Student Poster and Paper awards were announced by Karen Conzelman. Each award winner received a \$50 honorarium.

- Tim Widener, from ASU, West campus, for his poster presentation on the “Elucidation of novel Vitamin D receptor interacting proteins: Implications for human disease.”
- Jan Egan from ASU and U of A for her poster, “Vitamin D and APC modulate molecular crosstalk between β -catenin/WNT signaling and the Vitamin D receptor in colon cancer cells”
- Lydia Edgewater from NAU for her presentation during the chemistry session on “Possible environmental exposures of uranium from sheep”

The slate of nominees for elected positions on the Board of Governors for 2008-2009 was announced:

- President – Robert Reavis
- President-Elect – Robert McCord
- Past President and Recording Secretary – Buck Jones
- Membership Secretary – Ingrid Novodvorsky
- Treasurer – Karen Conzelman
- Director-Central Arizona – Erik Gergus
- Director – Northern Arizona – Shaifiu Jibrin
- Director – Southern Arizona – open
- Director – Nevada – open

The nominees were approved by the membership.

The meeting was turned over to the new President, Robert Reavis. President Reavis encouraged those in attendance to renew their membership and announced that the 2009 Annual Meeting would be held at the University of Arizona, in Tucson. In the absence of additional business, the meeting was adjourned at 1:17 pm.

Karen Conzelman

(for the Recording Secretary, Elizabeth Hull)

MEMBERSHIP REPORT

We currently have a total of 80 ANAS members, which includes 37 dues-paying members and 63 emeritus or life members who are exempt from annual dues.

Pamela Marshall

Membership Secretary

OUTSTANDING SERVICE AWARD

AREGAI TECLE, PH.D.

Dr. Tecle is a Professor in the School of Forestry at Northern Arizona University. His research concentrates on hydrologic modeling, water quality analysis and natural resource management. In addition to his scientific contributions, Aregai has served the Academy in many leadership capacities since first becoming a member in 1999. Aregai has served on the Governing Board as the Northern AZ Director, President-Elect, President, and Past President. He has solicited sponsorship for and organized several well-attended Annual Meetings at NAU. Dr. Tecle has reviewed applications and made funding recommendations for the Academy's student Grants-in-Aid program for the last several years. In addition to being an associate editor for the Academy's journal (*JANAS*) and a relatively frequent author, Aregai worked with several other members to put together a special issue of the journal on Watershed Management in Arizona in 2003 (Volume 35(1)). He also is an active recruiter of new members to the Academy.

Dr. Tecle received his Ph.D. from the University of Arizona in 1988. Among his research goals are to gain a better understanding of the relationships between different ecosystem components in order to improve natural resource management strategies. His laboratory also works on multi-criterion decision-making techniques as tools for holistic ecosystem management. Dr. Tecle has served as mentor and advisor for over ten graduate students.

Anthony Brazel

Karen Conzelman

Betsy Cooper

Sandra Wardwell

Stephen Williams

Outstanding Service Award Committee

OUTSTANDING TEACHER AWARD

The recipient of this year's Outstanding Teacher Award is:

MS. BASAYNE-SMITH of the La Paloma Academy, Central in Tucson Arizona. Her hands-on lessons are engaging and well thought out. She is well liked and respected by the staff, parents and students. One of Ms. Basayne-Smith's favorite eight-grade projects is modeling atoms. It's a very creative and hands-on way to have students demonstrate their understanding of atomic structure by creating a model atom.

William Perry Baker

Outstanding Teacher Award Committee

GRANTS-IN-AID RECIPIENTS

The Undergraduate Grants-in Aid winner is **DOUGLAS J. MAHANA**

Douglas Mahana is a student of Dr. Elizabeth Arnold and works as a volunteer in her lab. The grant is for his research work on Endophyte Diversity and Identification for Bioactivity. In this research Douglas will examine the diversity of endophytic fungal communities within plant communities in tropical forests. He has two goals in this effort: (1) to compare the diversity of endophytes between rare host trees and their more common relatives, and (2) to identify species with bioactivity against a range of human pathogens.

The winners for the Graduate Grants-in Aid are **MARY JANE EPPS** and **ANDREW KOWLER**

Mary Jane Epps is a Ph.D. student of Dr. Elizabeth Arnold in Ecology and Evolutionary Biology at the University of Arizona. The title of her project is Dispersal of Sky Island forest Fungi by the Mushroom-feeding Beetle, *Gibbifer californicus* (*Erotylidae*). Mary Jane proposes to examine the fast-evolving nuclear ribosome internally transcribed spacer and a portion of the nuclear ribosomal large subunit from each morphotype, thus allowing her to identify each fungus of interest.

Andrew Kowler is a student of Professor Vance T. Holiday of the Department of Anthropology and Geosciences. The title of the project is "paleoclimatic significance of playa-lake expansion and contraction during the late Pleistocene and Holocene in the USA-Mexico borderlands of Arizona and New Mexico". In his research, Andrew proposes to establish and refine existing radiocarbon (^{14}C) chronologies for Paleolakes Cochise (Wilcox Playa) and Playas (Playas Valley Dry Lake) in the borderlands of Arizona and New Mexico, respectively. Specifically, he plans to quantify past changes in lake surface area, which is the proper gage of lake response to change in the hydrologic balance.

Aregai Tecle
Grants-in-Aid Committee

SCIENCE BOWL/SCIENCE OLYMPIAD LIAISON'S REPORT
REPORT OF THE SCIENCE BOWL/SCIENCE OLYMPIAD LIAISON

The Arizona Science Olympiad and Arizona Regional Science Bowl held their annual tournaments at Glendale Community College (GCC) on February 21, 2009. This year, both tournaments saw repeat winners, with the same two schools as last year coming up in the number one position.

The 2009 Arizona Division C Science Olympiad brought together 30 teams from 23 different Arizona high schools including schools from as far away as Teec Nos Pas as well as several from Tucson and the metro Phoenix area. All together nearly 400 high school students competed in events covering a broad spectrum of scientific disciplines, engineering, math and technology. Ribbons and medals were presented to the top seven finishers in each of the 25 different events. In addition, gift certificates, cash prizes or scholarships were awarded to top finishing teams competing in the following events: Astronomy, Cell Biology, Chemistry Lab, Disease Detective, Dynamic Planet, Ecology, Egg-O-Naut, Electric Vehicle, Elevated Bridge, Experimental Design, Forensics, Fossils, Health Science, It's About Time, Junkyard Challenge, Math Applications for Today's Technologies, Physics Lab, Remote Sensing, Technical Problem Solving, Trajectory, WindWatts, and Write It-Do It. These awards were endowed by donations from the following sponsors: Arizona Council of Engineering and Scientific Associations, Charles Hoyt, Everett Greenli, GCC, Salt River Project, Southwest Gas, and Stan and Susan Celestian. ANAS awarded \$1000 in supply money to ten teams that competed in Environmental Chemistry and Trajectory as well as a total of \$100 to the top scoring schools in Ecology and Herpetology in memory of former State Director and ANAS fellow Bud Ellis. The following Academy members were among the 70+ volunteers who helped with the tournament: Robert Bowker, Pedro Chavez, Karen Conzelman, Elizabeth Cooper, Erik Gergus, Robert Reavis, Ryan Sawby, Florence Slater, James Tuohy, and Steve Williams.

The school selected to receive the Hoyt Spirit Award was Catalina Foothills High School in Tucson. Named in honor of longtime ANAS member and founder of the Arizona Science Olympiad program Charles Hoyt, this award recognizes the team that best epitomizes the spirit of the Science Olympiad. The Hoyt Spirit Award was established as an annual honor by the Arizona Science Teachers Association in 2006. Canyon del Oro from Oro Valley, AZ was recognized as the top ranking new team to the state tournament with the Rookie of the Year award, sponsored by the Employee Community Fund of Boeing Mesa.

At the conclusion of the competition, the top seven ranked teams overall were announced and presented with plaques and trophies. The winner, Catalina Foothills High School–Blue, from Tucson, along with their head coach Kiki Moore, and Arizona State Co-Director Hal Eastin will represent Arizona at the national Science Olympiad in Augusta, GA in May. Catalina placed 18th overall out of 60 teams at last year's National tournament. This was quite an impressive accomplishment considering that in no Arizona C team had placed higher than 40th in the last five years. Additional information

about the Science Olympiad can be found at <http://www.gccaz.edu/biology/so>
On the same day, 28 teams of 4-5 students each competed in this year's Regional Science Bowl. Teams came from Chandler, Fountain Hills, Mesa, Paradise Valley, Phoenix, Scottsdale, Tempe and Tucson high schools to participate. After six hours of double elimination rounds, the team from Brophy College Preparatory Academy in Phoenix came out on top for the second year in a row, beating Tempe Preparatory Academy in the final round, 68-52. Twenty-five hundred dollars in scholarships were awarded to the top four schools (2nd – Tempe Preparatory Academy, 3rd - BASIS Tucson-Team 1, 4th - Phoenix Country Day). Brophy will represent the state at the Department of Energy's National Science Bowl in Washington DC April 30-May 5. For more information, see <http://www.wapa.gov/dsw/scibowl/>.

Next year's tournaments are planned for Saturday, March 6, 2010 at GCC. If Academy members, their institutions or foundations are interested in getting involved in any capacity, please contact the SO/SB liaison (alison.waterkotte@srpnet.com). Volunteers and sponsorship dollars are always welcomed.

Alison Waterkotte
Science Bowl/Science Olympiad Liaison

TREASURER'S REPORT

2008

Operating and Short Term Reserve Fund (Vanguard Prime Money Market Fund)

Account Value on 12/31/07	\$26,108.13
Dividend Deposits	+724.09
Account Value on 12/31/08	\$26,832.22

Goethe Educational Endowment Fund (Vanguard Index 500 Mutual Fund)

Account Value on 12/31/07 (201.934 shares at \$135.15/share)	\$27,291.38
Transferred Donations +2.814 shares	Total: 204.748 shares
Dividends +4.925 shares	Total: 209.673 shares
Account Value on 12/31/08 (209.673 shares at \$83.09/share)	\$17,421.73

General Fund

December 31, 2007 Balance	\$6,676.61
Transferred to Goethe Educational Endowment Fund	- 225.00
Deposits	+ 9,741.25
Expenses	- 8,884.91
Transferred to ASU General Fund	- 3,700.00
December 31, 2008 Balance	\$3,607.95

ASU General Fund

December 31, 2007 Balance	\$1,344.01
Transfer from General Fund	+3,700.00
Expenses	- 3,842.37
December 31, 2008 Balance	\$1,201.64

Science Olympiad General Fund

December 31, 2007 Balance	\$46,652.48
Deposits	+29,259.31
Expenses	- 18,947.96
December 31, 2008 Balance	\$56,963.83

Science Bowl General Fund

December 31, 2007 Balance	\$4,983.42
Deposits	+3,990.00
Expenses	- 7,426.22
December 31, 2008 Balance	\$1,547.20

Market Value of Assets (as of December 31, 2008) **\$ 107,574.57**

<u>Deposits</u>	<u>General Funds Details</u>	<u>Expenses</u>
\$2,580.00	ANAS Membership dues	
	PayPal charges	36.72
	Journal:	
1,250.00	Subscriptions	
	Refunds	160.00
1,480.25	BioOne Royalties	
349.00	Sale of Back Issues	
1,785.00	Reprints/Page Charges	
	Printing	3,380.79
	Typing	1500.00
	Postage	256.14
32.00	Hydrology Proceedings	
	Web hosting fee	0.00
	Scholarships:	
	Scholarships	2000.00
	Committee Expenses/Postage	0.00
	Grants-in-Aid, High School:	
	Grants	100.00
	Printing/Postage	0.00
	Grants-in-Aid, Graduate	0.00
	Grants-in-Aid, Undergraduate	0.00
	Science Olympiad awards	1,100.00
	Annual Meeting:	
2,040.00	Registration Fees	53.10
	PayPal Charges	48.96
	Sponsor donations	
	Proceedings, Printing	714.78
	Proceedings, Postage	90.95
	Coffee Breaks	1197.85
	Friday Reception	170.30
	Saturday Luncheon	1314.71
	Meeting Rooms	0.00
	Awards	
	Outstanding Service	50.00
	Outstanding Teacher	50.00
	Printing/Postage	0.00
	Plaques	41.23
	Best Student Papers	150.00
	Supplies	29.49
225.00	Goethe Endowment Fund Contributions	
	AZ Corporation Commission	10.00
	NAAS Dues	46.40

	Supplies	0.00
	Postage/Office	31.40
	Printing/Office	180.46
	Bank Charges	14.00
9,741.25	SUBTOTAL	12,727.28
<u>Deposits</u>		<u>Expenses</u>
514.31	Science Olympiad	
20,950.00	Interest	
7,032.00	Sponsor donations	
	Membership dues	1,800.00
	Tournament	
	Awards and Prizes	4,343.81
	Scholarships	0.00
	Team Travel	2,800.00
177.00	T-shirts	4,433.45
	Supplies	219.91
586.00	Lunches	833.07
	Coaches gifts	650.00
	Office Expenses	
	Copying and Postage	236.46
	Bank Charges	0.00
	Outreach	
	Workshop stipends	1,080.00
	Seed money	1,500.00
	Brochures/PR	260.00
	Mileage	32.26
	Video Production	400.00
	Travel to Nationals (State Director)	359.00
29,259.31	SUBTOTAL	18,947.96
2,800.00	Science Bowl	
1,190.00	Sponsor donations	
	School registration fees	0.00
	Scholarships	3,750.00
	Room rental fees	0.00
	Photographers	100.00
	Food	2,064.83
	Supplies	243.60
	Conference registration fees	0.00
	Trophies and prizes	1,267.79
3,990.00	SUBTOTAL	7,426.22
\$42,990.56	TOTALS	\$39,101.46

Karen Conzelman
Treasurer